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STEPHEN A GRATTON
THE LAW OFFICE OF STEVE GRATTON
2764 SOUTH BRAUN WAY
LAKEWOOD, CO 80228

EXAMINER	
LEWIS, MONICA	

ART UNIT	PAPER NUMBER
2822	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/646,897	FARNWORTH ET AL.	
	Examiner	Art Unit	
	Monica Lewis	2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 July 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *170-179 and 262-271* is/are pending in the application.

4a) Of the above claim(s) *174,178 and 179* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *170-173,175-177 and 262-271* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 April 2006* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *07/07*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. This office action is in response to the response filed July 18, 2007.

Specification

2. The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. Claims 170, 172, 173, 175-177, 264 and 270 are rejected under 35 U.S.C. 103(a) as obvious over Brooks (U.S. Patent No. 5,496,775) in view of Farnworth et al. (U.S. Patent No. 6,620,731) and *Moisture Absorption in No-Flow Underfill Materials and its Effect on Interfacial Adhesion to Solder Mask Coated FR4 Printed Wiring Board* by Ferguson et al.

In regards to claim 170, Brooks discloses the following:

a) a semiconductor die (30), circuit side, a back side, four peripheral edges, and a plurality of die contacts on the circuit side (For Example: See Figure 4);

b) a plurality of contact bumps (32) on the die contacts (For Example: See Figure 4);

c) a first polymer layer (36B) covering the circuit side, the contact bumps and the peripheral edges, the first polymer layer having a first planar surface and edge polymer layers covering the peripheral edges (For Example: See Figure 4); and

d) a second polymer layer (36A) covering the back side having a second planar surface, the first polymer layer and the second polymer layer encapsulating the die on six sides and supporting the die, the contact bumps and the peripheral edges (For Example: See Figure 4).

In regards to claim 170, Brooks fails to disclose the following:

a) a thinned die.

However, Farnworth et al. ("Farnworth") discloses a semiconductor device that has a thinned die (For Example: See Column 8 Lines 61-67). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include a thinned die as disclosed in Farnworth because it aids in exposing conductive members (For Example: See Column 8 Lines 61-67).

Additionally, since Brooks and Farnworth are both from the same field of endeavor, the purpose disclosed by Farnworth would have been recognized in the pertinent art of Brooks.

b) polymer material comprising a self planarizing thermoset underfill film which is rigidifying.

However, Ferguson et al. ("Ferguson") discloses a semiconductor device where the polymer material comprising a self planarizing thermoset underfill film which is rigidifying (For Example: See Page 327). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include polymer material comprising a self planarizing thermoset underfill film which is rigidifying as disclosed in Ferguson because it aids in providing resistance to moisture (For Example: See Page 327).

Additionally, since Brooks and Ferguson are both from the same field of endeavor, the purpose disclosed by Ferguson would have been recognized in the pertinent art of Brooks.

Finally, the following limitation makes it a product by process claim: a) "self-planarizing thermoset;" and b) "rigidifying." The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claims 172 and 270, Brooks fails to disclose the following:

a) the underfill cures and planarizes at a temperature of about 200-250, has a Young's modulus of about 4G Pascal, and a coefficient of thermal expansion (CTE) of about 33 parts per million per C.

Finally, the following limitation makes it a product by process claim: a) "the underfill cures and planarizes at a temperature of about 200-250, has a Young's modulus of about 4G Pascal, and a coefficient of thermal expansion (CTE) of about 33 parts per million per C." The MPEP § 2113, states, "Even though product -by[-] process claims are limited by and defined by

the process, determination of patentability is based upon the product itself. The patentability of a product does not depend on its method of production. If the product in product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product is made by a different process." *In re Thorpe*, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

A *"product by process"* claim is directed to the product per se, no matter how actually made, *In re Hirao and Sato et al.*, 190 USPQ 15 at 17 (CCPA 1976) (footnote 3). See also *In re Brown and Saffer*, 173 USPQ 685 (CCPA 1972): *In re Luck and Gainer*, 177 USPQ 523 (CCPA 1973); In re Fessmann, 180 USPQ 324 (CCPA 1974); and *In re Marosi et al.*, 218 USPQ 289 (CAFC 1983) final product per se which must be determined in a *"product by, all of"* claim, and not the patentability of the process, and that an old or obvious product, whether claimed in *"product by process"* claims or not. Note that Applicant has the burden of proof in such cases, as the above caselaw makes clear.

In regards to claim 173, Brooks fails to disclose the following:

a) the second polymer layer comprises the underfill film.

However, Ferguson discloses a semiconductor device where the polymer material comprising an underfill film (For Example: See Page 327). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include polymer material comprising underfill film as disclosed in Ferguson because it aids in providing resistance to moisture (For Example: See Page 327).

Additionally, since Brooks and Ferguson are both from the same field of endeavor, the purpose disclosed by Ferguson would have been recognized in the pertinent art of Brooks.

In regards to claim 175, Brooks discloses the following:

a) a plurality of terminal contacts on the contact bumps (For Example: See Figure 4).

In regards to claim 176, Brooks discloses the following:

a) the first polymer layer has a thickness which is less than a height of the contact bumps and each contact bump is surrounded by a portion of the first polymer layer (For Example: See Figure 4).

In regards to claim 177, Brooks fails to disclose the following:

a) the die includes conductive vias in electrical communication with the die contacts and the contact bumps.

However, Farnworth discloses a semiconductor device that utilizes a plurality of conductive vias (30) in the die electrical communication with contacts (38) (For Example: See Figures 1A-1G and Column 4 Lines 1-4). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include a plurality of conductive vias as disclosed in Farnworth because it aids in providing electrical communication between the integrated circuit and the contacts (For Example: See Abstract).

Additionally, since Brooks and Farnworth are both from the same field of endeavor, the purpose disclosed by Farnworth would have been recognized in the pertinent art of Brooks.

In regards to claim 264, Brooks discloses the following:

a) a plurality of terminal contacts comprising ball bonds on the contact bumps (For Example: See Figure 4).

5. Claims 178, 262 and 265-267 are rejected under 35 U.S.C. 103(a) as obvious over Brooks (U.S. Patent No. 5,496,775) in view of Farnworth et al. (U.S. Patent No. 6,620,731) and *Moisture Absorption in No-Flow Underfill Materials and its Effect on Interfacial Adhesion to Solder Mask Coated FR4 Printed Wiring Board* by Ferguson et al and Kinsman et al. (U.S. Patent No. 6,717,245).

In regards to claim 178, Brooks fails to disclose the following:

a) the die contacts comprise a bond pads.

However, Kinsman discloses die contacts (12) that comprise bond pads (For Example: See Figure 2). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include die contacts that comprise bond pads as disclosed in Kinsman because it aids in providing a connection among the components (For Example: See Figure 2).

Additionally, since Brooks and Kinsman are both from the same field of endeavor, the purpose disclosed by Kinsman would have been recognized in the pertinent art of Brooks.

In regards to claim 262, Brooks fails to disclose the following:

a) the die contacts comprise a solderable metal and the contact bumps comprise solder.

However, Kinsman discloses die contacts that comprise a solderable metal and the contact bumps comprise solder (For Example: See Column 5 Lines 1-13). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include die contacts that comprise a solderable metal and the contact bumps comprise solder as disclosed in Kinsman because it aids in providing a connection among the components (For Example: See Column 5 Lines 1-13 and Figure 2).

Additionally, since Brooks and Kinsman are both from the same field of endeavor, the purpose disclosed by Kinsman would have been recognized in the pertinent art of Brooks.

In regards to claim 265, Brooks fails to disclose the following:

a) the first polymer layer on each edge comprises a portion of a polymer filled trench.

However, Kinsman discloses a semiconductor device that has a polymer filled trench (26) (For Example: See Figure 1D). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include a polymer filled trench as disclosed in Kinsman because it aids in providing hermetic sealing (For Example: See Column 6 Lines 38-41).

Additionally, since Brooks and Kinsman are both from the same field of endeavor, the purpose disclosed by Kinsman would have been recognized in the pertinent art of Brooks.

In regards to claim 266, Brooks discloses the following:

a) the edge polymer layers and the back side have a same planar surface (For Example: See Figure 4).

In regards to claim 267, Brooks discloses the following:

a) the edge polymer layers have a selected thickness which is different than a thickness of the first polymer layer (For Example: See Figure 4, Column 2 Lines 65-67 and Column 3 Lines 1-5).

6. Claims 171 and 268 are rejected under 35 U.S.C. 103(a) as obvious over Brooks (U.S. Patent No. 5,496,775) in view of Farnworth et al. (U.S. Patent No. 6,620,731) and *Moisture Absorption in No-Flow Underfill Materials and its Effect on Interfacial Adhesion to Solder Mask Coated FR4 Printed Wiring Board* by Ferguson et al. and Beffa et al. (U.S. Patent No. 6,233,185).

In regards to claim 171, Brooks fails to disclose the following:

a) the die comprises a tested and burned in die and the component comprises a known good component (KGC).

However, Beffa et al. ("Beffa") discloses a semiconductor device that has a die that comprises a tested and burned in die and the component comprises a known good component (For Example: See Column 1 Lines 9-12). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include a die that comprises a tested and burned in die and the component comprises a known good component as disclosed in Beffa because it aids in determining which die is functional (For Example: See Column 1 Lines 30-32).

Additionally, since Brooks and Beffa are both from the same field of endeavor, the purpose disclosed by Beffa would have been recognized in the pertinent art of Brooks.

In regards to claim 268, Brooks fails to disclose the following:

a) the thinned die comprises a tested and burned in die.

However, Beffa discloses a semiconductor device that has a die that comprises a tested and burned in die (For Example: See Column 1 Lines 9-12). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor

of Brooks to include a die that comprises a tested and burned in die as disclosed in Beffa because it aids in determining which die is functional (For Example: See Column 1 Lines 30-32).

Additionally, since Brooks and Beffa are both from the same field of endeavor, the purpose disclosed by Beffa would have been recognized in the pertinent art of Brooks.

7. Claim 263 is rejected under 35 U.S.C. 103(a) as obvious over Brooks (U.S. Patent No. 5,496,775) in view of Farnworth et al. (U.S. Patent No. 6,620,731) and *Moisture Absorption in No-Flow Underfill Materials and its Effect on Interfacial Adhesion to Solder Mask Coated FR4 Printed Wiring Board* by Ferguson et al. and Farnworth et al. (U.S. Patent No. 6,097,087).

In regards to claim 263, Brooks discloses the following:

a) the terminal contacts on the die in electrical communication with contact bumps in a standardized grid array.

However, Farnworth discloses a semiconductor device that has terminal contacts in a grid array (For Example: See Column 1 Lines 30-36). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include terminal contacts in a grid array as disclosed in Farnworth because it aids in permitting high input/output capability (For Example: See Column 1 Lines 31-37).

Additionally, since Brooks and Farnworth are both from the same field of endeavor, the purpose disclosed by Farnworth would have been recognized in the pertinent art of Brooks.

8. Claim 269 is rejected under 35 U.S.C. 103(a) as obvious over Brooks (U.S. Patent No. 5,496,775) in view of Farnworth et al. (U.S. Patent No. 6,620,731), *Moisture Absorption in No-Flow Underfill Materials and its Effect on Interfacial Adhesion to Solder Mask Coated FR4 Printed Wiring Board* by Ferguson et al. and Lin (U.S. Patent No. 5,436,203).

In regards to claim 269, Brooks fails to disclose the following:

a) the thinned die is contained on a semiconductor wafer having a polymer support dam proximate to edges thereof.

However, Lin discloses a semiconductor device that has a polymer dam (40) (For Example: See Figure 4). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include a polymer dam as disclosed in Lin because it aids in constraining the flow of the encapsulant (For Example: See Column 4 Lines 66-68).

Additionally, since Brooks and Lin are both from the same field of endeavor, the purpose disclosed by Lin would have been recognized in the pertinent art of Brooks.

9. Claim 271 is rejected under 35 U.S.C. 103(a) as obvious over Brooks (U.S. Patent No. 5,496,775) in view of Farnworth et al. (U.S. Patent No. 6,620,731), *Moisture Absorption in No-Flow Underfill Materials and its Effect on Interfacial Adhesion to Solder Mask Coated FR4 Printed Wiring Board* by Ferguson et al. and *Functional and Smart Materials* by Wang.

In regards to claim 271, Brooks fails to disclose the following:

a) the second polymer layer comprises parylene.

However, Wang discloses a semiconductor device that has parylene (For Example: See 4.2.3). It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include parylene as disclosed in Wang because it aids in providing high reliability (For Example: See 4.2.3).

Additionally, since Brooks and Wang are both from the same field of endeavor, the purpose disclosed by Wang would have been recognized in the pertinent art of Brooks.

Response to Arguments

10. Applicant's arguments filed 7/18/07 have been fully considered but they are not persuasive. First, Applicant argued that "the first polymer layer 36B does not cover the edges of the die 30." However, Brooks does cover the edges of the die (For Example: See Figure 4).

Second, Applicant argued that the "prior art does not disclose an underfill film used to seal and encapsulate a thinned die...Ferguson et al. discloses a deposited underfill material...the cited passage doesn't suggest using a thermoset underfill material to rigidify the edges of a thinned die." However, Ferguson is not being utilized to disclose a thinned die. Ferguson is being utilized to disclose a polymer material comprising a self planarizing thermoset underfill film which is rigidifying (For Example: See Page 327).

Third, Applicant argued that "the term rigidifying is not associated with any process but rather is a functional limitation...an underfill film which rigidifies the edges of a thinned die is missing from the art." However, Ferguson discloses a semiconductor device where the polymer material comprising a self planarizing thermoset underfill film which is rigidifying (For Example: See Page 327).

Fourth, Applicant argued that the proposed reason for the combination of Farnworth and Brooks "makes no sense." However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the semiconductor of Brooks to include a thinned die as disclosed in Farnworth because it aids in exposing conductive members (For Example: See Column 8 Lines 61-67). There is nothing saying that the conductive member has to be a via.

Fifth, Applicant argued that "Brooks already uses thermoset materials (epoxy) for encapsulation...such that the proposed reason for the combination makes no sense." Although Brooks discloses the use of thermoset materials, Brooks failed to disclose a self planarizing thermoset underfill film which is rigidifying. Therefore, Ferguson was utilized to disclose that limitation.

Sixth, Applicant argued that "the underfill cures and planarizes at a temperature of about 200-250, has a Young's modulus of about 4G Pascal, and a coefficient of thermal expansion (CTE) of about 33 parts per million per C...the Office Action characterizes these limitations as being product by process...this incorrect as the limitations define physical characteristics of the underfill film. However, curing and planarization are process limitations.

Seventh, Applicant argued that "Brooks discloses gold ball towers which is not the same as terminal contacts on contact bumps." However, the Examiner is permitted to give the broadest reasonable interpretation. Therefore, Brooks discloses a plurality of terminal contacts on the contact bumps (For Example: See Figure 4).

Finally, Applicant argued that "claims 178 (bond pads) and 262 (solderable metal)...states that the proposed reason as it aids in providing a connection among the components...this statement is unclear." The areas are metallized areas to which electrical connections among the components can be made.

Conclusion

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monica Lewis whose telephone number is 571-272-1838. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith can be reached on 571-272-2429. The fax phone number for the organization

where this application or proceeding is assigned is 571-273-8300 for regular and after final communications.

ML

September 22, 2007

MONICA LEWIS
PRIMARY PATENT EXAMINER